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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/972,200	Applicant(s) KUNIEDA ET AL.	
	Examiner Kevin Siangchin	Art Unit 2623	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03 October 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Detailed Action

Preface

1. Before proceeding, it should be noted that the Applicant's disclosure is so inundated with inconsistencies, semantic and grammatical errors, and ambiguous language, that many portions are only marginally comprehensible. Examination will proceed, however, according to the best interpretation of the Applicant's claimed invention that could be obtained, in light of a defective and often incoherent disclosure.

Drawings

Objections

2. The drawings are objected to because of the following:

   a. In the caption of Fig. 1 the word "shape" is misspelled as "shap".

   b. In Fig. 3, the word "locates" is improperly used.

   c. The caption of Fig. 5 is incoherent, nearly devoid of grammatical structure and barely descriptive of the corresponding figure.

   d. The caption of block S7 in Fig. 6 misspells the word "Thinning" as "Tinning".

   e. In Fig. 8, the word "Thinning" is misspelled as "Tinning".

   f. In Fig. 8, items (b) and (d) do not show minutiae.

   g. In Fig. 9, the caption is not descriptive. Specifically, despite the caption, there is apparently no system for fingerprint authentication shown. Instead, a fingerprint is shown.

   h. Fig. 11 is not sufficiently illustrative of the corresponding description found on page 11 of the Applicant's specification (the last 3 paragraphs).

i. In Fig. 13 block S7, there is yet another misspelling of the word "Thinning".

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

Objections: Title of Invention

3. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Objections

4. 35 U.S.C. 112, first paragraph, requires the specification to be written in "full, clear, concise, and exact terms." The specification is replete with terms which are not clear, concise and exact. The specification should be revised carefully in order to comply with 35 U.S.C. 112, first paragraph. Examples of some unclear, inexact or verbose terms used in the specification are:

a. Deplorable grammar and semantics persist throughout the Applicant's specification. See, for example, lines 26-28 on page 4 ("...look precise *textile*...") of the Applicant's specification, the first sentence on page 8 of the Applicant's specification ("Detail true..."), lines 25-28 on page 7 of the Applicant's specification, lines 20-23 on page of the Applicant's specification, or the last paragraph on page 12 of the Applicant's specification.

b. Improper reference numbers abound the Applicant's specification. For example, on page 8, line 22 of the Applicant's specification the "minutia 22 close to bifurcation point" should be listed as minutia 21, in accordance with Fig. 7.

c. The Applicant uses the word *arc* improperly throughout the specification. An arc is a smooth curve joining two points. For instance, in Fig. 1, the arc between points 30 and 31

would be the portion of the curve spanning these points, not the line spanning them as the Applicant insists. This line is typically referred to as a *chord.* See the attached Mathworld (© Wolfram Research and CRC Press) definitions.

d. The following excerpt from page 10, lines 28-30 is imprecise:

> [The inner product or the cosine of the angle between the two lines] means that if the value is large, the angle between two lines is narrow and if otherwise, the angle between two lines is wide.

Whether the angle between two lines (or, more precisely, two vectors) is obtuse or acute depends on the *sign* of the inner product, not the magnitude (i.e. whether it is large or small). If the inner product is positive, the angle is acute. If it is negative, the angle is obtuse. And, if it is zero, then the vectors are perpendicular.

e. The last paragraph on page 11 is incomprehensible. Specifically, according to this paragraph:

> If the value of similarity function between two minutia is large, the possibility of displacement (Xb-Xa,Yb-Ya) of the former fingerprint image is high. On the contrary, if the value of similarity function between two minutia in different fingerprint images is small, the possibility of displacement (Xb-Xa, Yb-Ya) of the former fingerprint image is small.

At first blush, this excerpt seems to imply that if there is a displacement between two fingerprint images, say A and B (image A, having minutia (Xa,Ya), and Image B, having minutia (Xb,Yb)), then they are similar. Yet, when this displacement is small, image A and image B are dissimilar. This is not only contrary to typical fingerprint detection systems, where similar fingerprints have matching minutia, it is contrary to the definition of similar. How can a pair of images having displaced fingerprints be more similar than a pair depicting fingerprints (assuming the same fingerprints) that closer?

f. The following sentence (page 12, lines 32-34 of the Applicant's specification) is completely vacuous: "To compensate displacement due to rotation, all the minutia of input fingerprint image are compensated for rotation". Within the context in which it is found, this sentence essentially says: "to compensate for rotation (of the minutia), all of the minutia of input fingerprint image are compensated for rotation".

g. Contrary to what the Applicant proposes (page 18, line 4 of the Applicant's

specification), each person (hopefully) has *10* fingers.

This is by no means an exhaustive list. A comprehensive review and revision of the Applicant's specification is necessary. Appropriate correction is required.

5. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required. Claims 14-15 set forth applications of the Applicant's claimed invention that are not disclosed in the specification.

Claims

Objections

6. The Claims are replete with errors and informalities. For example,

   a. In claim 5, the Applicant uses the word *reversed* improperly. It is assumed that the Applicant intended to use the word reverse to indicate inverting an image. It is suggested that the word reversed be replaced with the more recognized term *inverted.*

   b. In claim 8 (line 6), the Applicant recites "for judge". This is clearly improper. The phrase should be replaced with "for judgment", etc.

   c. The phrase "under assumption of consecutive several frame inputs of identical fingerprint" in Claim 10 is completely redundant. By being dependant on Claim 7, it is assumed that consecutive several frames of an identical fingerprint are input.

An exhaustive list will not be provided. It is suggested that the Applicant comprehensively review the claims and remove all grammatical, semantic and typographical errors. Appropriate correction is required.

7. Claim 9 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a *previous* claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Notice that claim 9 is dependent on a subsequent claim (i.e. claim 10). Also note that the dependency is not part of the preamble as per 37 C.F.R § 1.75(e).

Rejections Under 35 U.S.C. § 112(2)

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claim 1-16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

10. *The following is in regard to Claim 1-16.* The claim(s) are narrative in form and replete with indefinite and functional or operational language. The structure which goes to make up the device must be clearly and positively specified. The structure must be organized and correlated in such a manner as to present a complete operative device. The claim(s) must be in one sentence form only (i.e. **there should be *one* period *per* claim**). Note the format of the claims in the patent(s) cited.

11. *The following is in regard to Claim 1.* Claim 1 recites "the data of lengths of arcs being between starting measure point and ending measure points among every 3 consecutive measure points on the curve". This phrase is unintelligible. This phrase will be interpreted as "the lengths of the arcs are taken between the starting measure point and ending measure point for every 3 consecutive measure points on the curve". This interpretation is consistent (at least, as far as can be told) with the Applicant's specification.

12. *The following is in regard to Claim 2.* Claim 2 recites the limitation "the periodic discrete grids". There is insufficient antecedent basis for this limitation in the claim. Regarding claim 2, the phrase "such as" (i.e. as in "such as a digital image") renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d). Claim 2 recites "...whose distances from starting measure point are less and greater than the specified value, respectively" (Claim 2, lines 5-6). Clearly, a distance cannot be simultaneously less and greater than a specified value. The word "respectively" is not used properly in Claim 2 since it does not resolve between the "positions of two nearest adjacent grids on the curve" (Claim 2, lines 4-5). With regard to the word *grids,* it is unclear why the applicant is referring to more than one grid. This is not consistent with any portion of the Applicant's disclosure. Secondly, it is not clear how a grid would be on the curve. This just does

not make any sense (*A curve is one dimensional. Generally, a grid is at least two-dimensional. Having a grid on a curve, therefore, defies the axioms of Euclidean geometry!*). Furthermore, the Applicant does not adequately define in the disclosure what constitutes a *grid*, at least within the context of the claimed invention. It seems that when referring to a grid the Applicant means an array of pixels that would constitute an image of the fingerprint. The term *grid* typically denotes a discretized two-dimensional (sometimes higher-dimensional) space. Grids are typically defined in terms of nodes (or the like) separated by some finite distance indicative of the degree to which the corresponding continuous two-dimensional space is sampled. Grids have a wide range of applications in fingerprint analysis, and image processing in general. Although a pixel array can be considered a grid, the term grid is seldom used to denote (or even describe) an array of image pixels. The Applicant is advised to either explicitly state that a grid denotes an array of pixels corresponding to a fingerprint image, or, more preferably, remove the misleading terminology altogether. Claim 2 will be interpreted as:

> The system as in claim 1 for recognition of *a* curve expressed on the periodic discrete grid such as *a* digital image, which determines *the* position of measure points by interpolating positions of two nearest adjacent pixels on the curve.

13. *The following is in regard to Claim 4.* Claim 4 recites the limitations "said minutia ridge shape" and "said ridge shape of secondary minutia". There is insufficient antecedent basis for this limitation in the claim.

14. *The following is in regard to Claim 5.* Claim 5 is barely comprehensible, let alone the fact that it does not particularly point out and distinctly claim the claimed subject matter. Claim 5 will be interpreted as follows:

> A system as in claim 3, wherein two extraction means for ending minutia are performed *using the* original black and white image and an *inverted* version of the original black and white image, instead of extracting both ending and bifurcation minutia *using just the* original black and white image.

15. *The following is in regard to Claim 6.* Claim 6 recites the limitation "it" in line 1. There is insufficient antecedent basis for this limitation in the claim. "it" will be assumed to refer to the system. On lines 9-10, the Applicant claims to calculate the inner product of a 2 point vector. This is inconsistent with the Applicant's specification and the typical definition of inner-product. The inner-product is typically calculated using two vectors. Therefore, it will be assumed that the Applicant is referring to the inner product of 2 vectors. This, however, does not resolve the definition of a point vector. The Applicant's specification does not shed any additional light on what a point vector is. Point-vectors will be assumed to mean a vector-representation of a point in some (predefined) coordinate system. Claim 6 recites the limitation "said 2 points" in lines 12-13. There is insufficient antecedent

basis for this limitation in the claim. "said 2 points" will be assumed to refer to the said 2 point vectors. Claim 6 recites the limitation "3 said inner products" in lines 15 and 20. There is insufficient antecedent basis for this limitation in the claim. Nowhere in claim 6 (or parent Claim 1)is there any mention of *three* inner products. Furthermore, it is not clear as to what inner product "said inner products" refers to. Claim 6 recites the limitation "the similar inner products" in line 19. There is insufficient antecedent basis for this limitation in the claim. It is not clear, even in light of the Applicant's specification, what constitutes similarity of inner products within the context of the Applicant's invention. The phrase "similar" (as in "similar inner products") renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d). Claim 6 will be interpreted as follows:

> A system as in claim 1, including a cost effective calculation for judging true or false minutia, comprising:
>
> means for taking 2 dimension coordinates *with respect to* an origin located at a bifurcation point;
>
> means for taking 3 points on different ridges leaving from the bifurcation point with the same distances from the bifurcation point;
>
> means for calculating the inner products of all pairs of point-vectors that can be obtained from the 3 point-vector that correspond, respectively, to said 3 points[1];
>
> means for judging the bifurcation as a false bifurcation minutia if all calculated inner products are less than a specified value, and judging the bifurcation as a true bifurcation minutia, if all calculated inner products are not less than a specified threshold;
>
> and, means for judging ridge ending as a false ending minutia by using inner products over valleys if all inner products are less than a specified value, and, otherwise, judging the ending as a true ending minutia.

16. *The following is in regard to Claim 7.* Claim 7 recites the limitation "said way" in line 4. There is insufficient antecedent basis for this limitation in the claim.

17. *The following is in regard to Claim 8.* On lines 5-6, the Applicant recites, "means for employing memory area in 2 dimensional coordinates for judge". This phrase does makes absolutely no sense. It will be interpreted as "means for employing a 2 dimensional array (of memory locations)". On lines 11-12 of Claim 8, the Applicant recites, "...accumulating the similarity measure in the memory area, *whose coordinates* are the same as vectors between the positions of the said 2 minutia...". When referring to "whose coordinates" here, it is unclear which element of Claim 8 that these coordinates are associated with. The language seems to imply an association with either the similarity measure or the memory area. In either case, the language fails to make sense, since similarity

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1 There is no need to provide a definition of inner-product unless the Applicant uses the term in a way that is not typical or redefines the term altogether. This is not the case, so the definition should be omitted.

measures are typically scalar values and memory areas do not have coordinates, at least not in the mathematical sense of the word. This portion of claim 8 will be interpreted in light of page 12, lines 8-14 of the Applicant's specification, as it could best be understood (*deciphered*), and in light of what is generally known in the art. First, it will be assumed that "whose coordinates" is associated with the aforesaid memory area (or 2D array). Within this context, coordinates will be interpreted to mean memory locations (or array locations). The phrase "...accumulating the similarity measure in the memory area, whose coordinates are the same as vectors between the positions of the said 2 minutia..." will thus be interpreted as: "...accumulating the similarity measure, wherein the similarity measure is stored in a memory location corresponding to that of[2] the vector between the positions of the said 2 minutia...".

18. *The following is in regard to Claim 9.* The preamble does not permit the scope of the claimed subject matter to be ascertained. Specifically, claim 9 claims a curve recognition system *or* means for fingerprint verification. It is, therefore, unclear as to whether the Applicant is intent on claiming a curve recognition system or a means for fingerprint verification[3]. Claim 9 recites the limitation "said *same* angle" in line 8. There is insufficient antecedent basis for this limitation in the claim. As point out in the Objections above, Claim 9's dependency on Claim 10 is improper. Further, note that Claim 9 assumes a "compensation of displacement of fingerprints" or a "means for employing fingerprint matching method without compensation of displacement of fingerprints" (depending on how claim 9 is interpreted). First, it should be noted that the elements inherited from Claim 10 should be unambiguous. Secondly, claim 10 does not seem to put forth anything that can be regarded as a "compensation of displacement of fingerprints" or a "means for employing fingerprint matching method without compensation of displacement of fingerprints". Therefore, it is unclear what elements are incorporated into claim 9 by way of the phrase "as in Claim 10". To further stress this, the Applicant should realize that the features of Claim 10 do not seem

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2 The reason for using the language "corresponding to that of" here, in lieu of the word "same", found in the original claim language (and similarly in the Applicant's specification), was to avoid inconstancies associated with using the word "same". Storing the similarity measure in the same location in memory as the vector between the two minutiae would result in overwriting the data associated with the vector. According to the Applicant's disclosure, the claimed system makes subsequent use of that data. In that sense, the original claim language (i.e. using "same") would be inconsistent.

3 Incidentally, the two (i.e. a curve recognition system and a means for fingerprint verification) are unrelated, in and of themselves.

to correspond, in any appreciable way, to the elements of claim 9. As such, the subject matter of Claim 10 does not lend itself to limiting the features set forth in claim 9[4].

19. *The following is in regard to Claim 10.* Claim 10 claims a curve recognition system as in Claim 7. Claim 7 does not claim a curve recognition system. The phrase "6th of 25 seconds" in line 3 of Claim 10 doesn't make sense. Does it mean the 6th second of every 25 seconds or 1/6 of 25 seconds or, perhaps, 6/25 seconds (i.e. 0.24 seconds)? It is assumed, herein, that the Applicant intended 6/25 seconds (i.e. 0.24 seconds).

20. *The following is in regard to Claim 11.* Claim 11 recites the limitations "said numerical data" and "said way". There is insufficient antecedent basis for these limitations in the claim.

21. *The following is in regard to Claim 12.* Claim 12 recites the limitations "said thinning", "said thining", "said improvement", "said compensation", "said binarization", "said collection", and "said matching". There is insufficient antecedent basis for these limitations in the claim. Furthermore, it is unclear when the Applicant says, " a sequence of processing as ... thinning, ... improvement or ... compensation, ... binarization, ... thinning, ... collection and ... matching of fingerprint feature data expressed by 40 or 60 bytes data in size", what aspects of these processes or steps (e.g. thinning, improvement, etc.) are being expressed by 40 or 60 bytes. Does the applicant intend by this statement to mean that the entire program code (or the like), implementing these elements, comprise only 40 or 60 bytes? Such a claim would be incredible indeed. However, this interpretation follows most directly from the current language of Claim 12. A more plausible interpretation of claim 12 will be assumed here. It will be assumed that the said sequence of processing results in a representation of the fingerprint comprising 40 or 60 bytes. Even this is somewhat difficult to accept. See the U.S.C. § 112(1) rejections below.

22. *The following is in regard to Claim 13.* Claim 13 recites the limitations "said fingerprint feature data of 40 or 60 bytes" and "said fingerprint template". There is insufficient antecedent basis for these limitations in the claim.

23. *The following is in regard to Claim 16.* Claim 16 recites the limitation "the criterion of acceptance". There is insufficient antecedent basis for this limitation in the claim. The phrase, "logic operations among extracted feature data", in claim 16 is unclear. It seems to imply that there are logic operations associated with extracted feature data. Extracted feature data typically do not have logic operations associated with them. Claim 16 will be interpreted as,

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4 Put more simply, the dependency of Claim 9 on Claim 10 (besides the informalities discussed in the Objections) does not make much sense.

"A system as in claim 1, wherein a criteria of acceptance is decided by logic operations performed on or utilizing extracted feature data from plural fingerprints".

24. It should be apparent to the Applicant that the claims do not define the invention in a clear and unambiguous manner. The rejections above likely fail to provide an exhaustive list of claim language in violation U.S.C. § 112(2). It is suggested that the Applicant carefully and comprehensively revise the claims so that they are in accordance with U.S.C. § 112(2). No new matter may be entered.

Rejections Under 35 U.S.C. § 112(1)

25. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

26. Claim 1, 2, 10 and 12 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

27. *The following is in regard to Claim 1.* Claim 1 recites "... stores, regenerates, or matches shape of curves, by using a specified group of data in length *and/or* angle *and/or* position to express a shape of curve..." (Claim 1, lines 3-5). Regarding the Applicant's usage of "and/or", there is no embodiment, disclosed in the Applicant's specification, that would support the use of "or" – that is, the Applicant does not disclose "... stores, regenerates, or matches shape of curves, by using a specified group of data in length *or* angle *or* position to express a shape of curve...". In order to retain this language, the Applicant must disclose embodiments that support all permutations of "length *and/or* angle *and/or* position".

28. *The following is in regard to Claim 2.* The specification does not support "...interpolating positions of two nearest adjacent grids on the curve, whose distances from starting measure point are less and greater than the specified value, respectively" (Claim 2, lines 3-6). Specifically, the specification interpolates two positions located

at a specified distance from a starting point on the curve (last paragraph on page 4 of the Applicant's specification). There is no determination made as to whether the distances from starting measure point are less and greater than the specified value. The Applicant does not disclose interpolating positions of two nearest adjacent grids on the curve. Having more than one grid is not consistent with any portion of the Applicant's disclosure. Secondly, the Applicant does not disclose how a grid would be on the curve. This, incidentally, does not make any sense: A curve is one dimensional. Generally, a grid is at least two-dimensional. Having a grid on a curve would, therefore, defy the axioms of Euclidean geometry! Furthermore, the Applicant does not adequately define in the disclosure what constitutes a *grid,* at least within the context of the claimed invention. It seems that when referring to a grid the Applicant means an array of pixels that would constitute an image of the fingerprint. The term *grid* typically denotes a discretized two-dimensional (sometimes higher-dimensional) space. Grids are typically defined in terms of nodes (or the like) separated by some finite distance indicative of the degree to which the corresponding continuous two-dimensional space is sampled. Grids have a wide range of applications in fingerprint analysis and image processing, in general. Although a pixel array can be considered a grid, the term grid is seldom used to denote (or even describe) an array of image pixels. The Applicant is advised to either explicitly state that a grid denotes an array of pixels corresponding to a fingerprint image, or, more preferably, remove the misleading terminology altogether.

29. *The following is in regard to Claim 10.* The Applicant does not sufficiently describe how "it takes 6/25 seconds[5] to complete processing". As one of ordinary skill in the art would realize, the processing time of a given operation – even simple, processor-level instructions – can rarely, if ever, be assigned a single, monolithic value. Processing times of a given operation are typically stochastic and assigned to be within expected ranges. There several factors, in software and hardware, that make predicting processing time difficult (e.g. stochastic latencies in signal propagation, page faults, context switching, network lag, and so on). Taking this into account, the subject matter of claim 10 would require "undue experimentation" (*Fonar Corp. v. General Electric Co.*, 107 F.3d 1543, 1548-49, 41, USPQ2d 1801, 1804 [Fed. Cir. 1997]) by one of ordinary skill in the art to achieve. Claims to a specific processing time for a given operation (e.g. Claim 10) are, therefore, questionable.

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5 Recall how "6th of 25 seconds" is being interpreted.

30. *The following is in regard to Claim 12.* The Applicant does not specifyhow the thinning, improvement, compensation, binarization, collection, and matching would be expressed by 40 or 60 bytes, in a way that would enable one of ordinary skill in the art. The Applicant should be aware that 40 or 60 bytes represents a very small amount of data. Consider, for instance, that in modern computer systems, integers and floating point numbers are typically represented as 4 bytes. The operations (e.g. rotation, interpolation, sub-pixel positioning of minutiae, etc.) performed by the Applicant's claimed system seem, at first blush, to require such data types (among other things). 40 bytes, for example, would provide storage for only 10 floating point numbers or integers! (60 bytes is not much better). Does the applicant propose that a fingerprint, with its complex ridge structure, be expressed using only 10 floating point numbers or integers? Such a claim seems, without further elucidation, quite incredible.

31. It should be apparent to the Applicant that the specification does not adequately enable one of one of ordinary skill in the art to implement the claimed invention. The specification may fail to enable other claims that have not been listed above. It is suggested that the Applicant carefully and comprehensively revise the specification and clams so that they are in accordance with U.S.C. § 112(1). No new matter may be entered.

Rejections Under 35 U.S.C. § 102(e)

32. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

33. Claims 1, 4, 11, and 16 are rejected under 35 U.S.C. 102(e) as being anticipated by Jain et al. (U.S. Patent 6,487,306).

34. *The following is in regard to Claim 1.* Jain et al. disclose a system for processing and matching fingerprint images (Jain et al. Fig. 5) that utilizes a curved-based representation of a fingerprint (i.e. *an aligned string-based representation* – Jain et al. columns 5-6, *Summary of the Invention*). The method comprises:

(1.a.) Regenerating shapes of curves (e.g. representing the template fingerprint patterns as strings – Jain et al. column 8, lines 40-46).

(1.b.) Matching (Jain et al. Fig. 6, step 640 and column 8, lines 47-52) shape of curves (Jain et al. column 8, lines 40-46).

(1.c.) Storing shapes of curves. Clearly, Jain et al.'s system necessitates the storage of the string-representations. The storage (e.g. in an appropriate data structure, in memory 520 [Jain et al. Fig. 5], in database 530 [Jain et al. Fig. 5], etc.) of strings, though not explicitly disclosed, is an inherent feature of Jain et al.'s system.

(1.d.) Strings (i.e. shapes of curves) are represented by (Jain et al. Fig. 8B):

1. Length (Jain et al. column 10, lines 60-65).
2. Angle (e.g. $g_i(G_i)$ – Jain et al. Fig. 8B).
3. Position (e.g. minutia location 810 and ridge point p_i positions – Jain et al. Fig. 8B).
4. Sequence of several measure points (e.g. minutia and/or ridge points p_i) on the curve which are determined such that adjacent measure points are separated by the same distance (Jain et al. column 10, lines 60-65).
5. The lengths of the arcs are taken between the starting measure point and ending measure point for every 3 consecutive measure points on the curve. This should be clear from Jain et al. Fig. 8B, where for every 3 consecutive measure points, say p_{i-2}, p_{i-1}, and p_i, the length between starting measure point and ending measure point (e.g. the distance between p_{i-2} and p_{i-1}; and the distance between p_{i-1} and p_i) is measured.

Therefore, the system of Jain et al. sufficiently conforms to the fingerprint authentication system proposed by the Applicant in Claim 1.

35. *The following is in regard to Claim 4.* As shown above, Jain et al. disclose a system that satisfies the limitations of Claim 1. In the method of Jain et al., ridge information is associated with each minutiae (e.g. a first minutia, a secondary minutia, a tertiary minutia, etc.). See, for example, Jain et al. column 9, lines 14-21. This ridge information includes ridge shape (e.g. Jain et al. Figs. 1A-1B, Fig. 8A-8B, and Fig. 9). In this manner, the system of Jain et al. sufficiently conforms to the fingerprint authentication system proposed by the Applicant in Claim 4.

36. *The following is in regard to Claim 11.* As shown above, Jain et al. disclose a system that satisfies the limitations of Claim 1. The system of Jain et al. further comprises:

(11.a.) Means for extracting numerical data of fingerprint ridge shapes of a ridge leaving from the minutia (e.g. Jain et al. Ridge Extraction 320 of Jain et al. Fig. 3A).

(11.b.) Means for matching (e.g. Reference Matcher 605 in Jain et al. Fig. 6) the numerical data with template samples (e.g. templates 535 of Jain et al. Fig. 5) registered in advance. See Jain et al. column 9, lines 23-34.

In this manner, the system of Jain et al. sufficiently conforms to the fingerprint authentication system proposed by the Applicant in Claim 11.

37. *The following is in regard to Claim 16.* As shown above, Jain et al. disclose a system that satisfies the limitations of Claim 1. It should be clear that the criteria of acceptance (e.g. score *S* – Jain et al. Fig. 6, step 650) is decided by logic operations (all the various steps employed throughout the system of Jain et al. comprise logic operations) performed on or utilizing extracted feature data (e.g. minutiae, ridges, etc.) from plural fingerprints (e.g. template fingerprints – Jain et al. Fig. 5, reference number 535). In this manner, the system of Jain et al. sufficiently conforms to the fingerprint authentication system proposed by the Applicant in Claim 16.

Rejections Under 35 U.S.C. § 103(a)

38. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

39. Claims 8, and 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jain et al.

40. *The following is in regard to Claim 8.* As shown above, Jain et al. disclose a system that satisfies the limitations of Claim 1. The system of Jain et al. further includes:

(8.a.) Employing a 2-dimensional (2D) array (of memory locations) – e.g. an array of pixels constituting an image of an input or template fingerprint.

Also, the Applicant should appreciate the fact that the various data of Jain et al.'s system lend themselves, in particular, to storage in 2D array structures. The minutiae and ridge points, for example, are 2D constructs, having an x component and y component (Jain et al. Fig. 8B). A meaningful expression of their positions must, therefore, be 2-dimensional. Further note that the *translation vectors* (analogous to the Applicant's "vectors between the positions of the 2 minutia" discussed below) is also two-dimensional (Jain et al. column 12, lines 12-20). Therefore, while Jain et al. do not explicitly state the usage of 2D arrays (of memory locations) for storing these data, it would be readily understood by one of ordinary skill in the art that such structures are inherently provided.

(8.b.) Calculating a similarity measure (e.g. alignment score, A^2, or normalized matching score, S – see Jain et al. column 11, line 35 and column 22, lines 46-50, respectively) for each pair of minutia data (e.g. Jain et al. column 10, lines 31-36 and column 22, lines 41-45) between input fingerprint image and registered template fingerprint.

(8.c.) Accumulating the similarity measure. Notice from the expression in Jain et al. column 11, line 35 that the similarity measure (A^2) is accumulated. The matching score accumulates the number of matching or corresponding minutiae among the input and template fingerprint-string representations (e.g. Jain et al. column 8, lines 44-2). As mentioned previously, the correspondence among input and template minutiae and, hence, the number of corresponding minutiae are indicated by, *inter alia*, the alignment score.

(8.d.) Judging that the input fingerprint has been registered if the maximum value in memory area exceeds a specified value (e.g. alignment threshold score, a_s [Jain et al. column 10, lines 16-30] or various predefined thresholds of the matching score [Jain et al. column 22, lines 54-64]). In the case of the alignment threshold (Jain et al. column 10, lines 31-36),

the pairs of input and template minutiae having the best (i.e. highest) alignment score are considered to have a correspondence. Similarly, if the matching score exceeds the predefined threshold ([Jain et al. column 22, lines 54-64), then the input fingerprint matches the template (among the various templates 535 stored in the database depicted in Jain et al. Fig. 5) having the maximum score (Jain et al. column 3, lines 28-30).

41. Jain et al. do not, however, expressly show or suggest storing the similarity measure (e.g. A^2 and/or S) in a memory location corresponding to that of the vector between the positions of the pair of minutiae (e.g. $(\Delta x,\Delta y)$ – Jain et al. column 12, lines 15-17).

42. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to store the similarity measure in a memory location corresponding to that of the vector between the positions of the pair of minutiae. Applicant has not disclosed, nor can it be inferred, that storing the similarity measure in a memory location corresponding to that of the vector between the positions of the pair of minutiae provides an advantage, is used for a particular purpose or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected Applicant's invention to perform equally well if the similarity measure were stored in an arbitrary memory location that is functionally consistent with any practical constraints imposed by the hardware and software architecture of the claimed system. The stored similarity measure is equally accessible whether storing the similarity measure in an arbitrary memory location or a location corresponding to said vector. The content of similarity measure is not effected by where it is stored. Thus, the various processes of the Applicant's claimed system, which rely on the value of the similarity measure not its location, would proceed the same regardless of where that value is stored. Therefore, it would have been obvious to combine to one of ordinary skill in this art to modify the system of Jain et al. to obtain the invention as specified in Claim 8.

43. *The following is in regard to Claim 12.* As shown above, Jain et al. disclose a system that satisfies the limitations of Claim 1. It was also shown above that Jain et al. disclose "a sequence of processing" comprising: thinning, improvement (e.g. noise removal), compensation (e.g. for rotation), binarization, collection (e.g. of template images), and matching. It should be clear from Jain et al. Fig. 5 that the system is implemented on a computer system. At the time of the Applicant's claimed invention, computer systems capable of processing speeds of 100-million instructions/second were available. Official Notice is taken. Given this, it would have been obvious

to one of ordinary skill in the art, at the time of the applicant's claimed invention, to implement the system of Jain et al. on a computer capable of processing 100-million instructions/second.

44. Jain et al. does not expressly show or suggest express the fingerprint feature data (presumably obtained after performing the aforementioned steps) as 40 or 60 bytes of data.

45. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to express the fingerprint feature data (presumably obtained after performing the aforementioned steps) as 40 or 60 bytes. Applicant has not disclosed that expressing the fingerprint feature data (presumably obtained after performing the aforementioned steps) as 40 or 60 bytes, as opposed to some other number of bytes, provides an advantage, is used for a particular purpose or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected Applicant's invention to perform equally well by expressing the fingerprint feature data using 40 or 60 bytes or any reasonable amount of bytes, because the Applicant's claimed system relies solely on the content of the fingerprint feature data, not the amount of memory (number of bytes) required to contain it. Therefore, it would have been obvious to combine to one of ordinary skill in this art to modify Jain et al. to obtain the invention as specified in claim 12.

46. *The following is in regard to Claim 13.* As shown above, Jain et al. disclose a system that satisfies the limitations of Claim 1. Jain et al. further disclose:

(13.a.) Transferring a fingerprint template (e.g. templates 535 shown in Jain et al. Fig. 5) from outer device or terminal equipment (e.g. reference number 510A in Jain et al. Fig. 5). See Jain et al. Fig. 5.

(13.b.) Transferring result of matching with said templates through communication network (e.g. network 566 of Jain et al. Fig. 5) to outer device (e.g. reference number 510A) or terminal equipment (e.g. display 538 of Jain et al. Fig. 5).

Furthermore, it was shown above, with regard to claim 12, that it would have been obvious to combine to one of ordinary skill in this art to modify Jain et al. to obtain the invention as specified in claim 13, to express the fingerprint feature data as 40 or 60 bytes of data. Please refer to the discussion above relating to similar limitations put forth in Claim 12.

47. *The following is in regard to Claim 14.* As shown above, Jain et al. disclose a system that satisfies the limitations of Claim 1. It should be evident from Jain et al. Fig. 5 that the system of Jain et al. can be used with a terminal or stand-alone equipment. Furthermore, Jain et al. suggest the application of their system to security (Jain et al. column 20, lines 25-27). Though not explicitly stated by Jain et al., it was well known, at the time of the Applicant's claimed invention, that searches through personal history, key locks, issuance of tickets, access control, e-commerce, fund management in social welfare, service and financial organizations, and gate-entry are applications that require security. Official Notice has been taken. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to apply the system of Jain et al. as a means for providing security in the following circumstances: searches through personal history, key locks, issuance of tickets, access control, e-commerce, fund management in social welfare, service and financial organizations, and gate-entry are applications that require security. The motivation to do so would have been to authenticate a user via his/her fingerprint to allow secure execution of or access to: searches through personal history, key locks, issuance of tickets, access control, e-commerce, fund management in social welfare, service and financial organizations, and gate-entry are applications that require security.

48. Claims 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jain et al. in view of Sparrow (U.S. Patent 4,817,183).

49. *The following is in regard to Claim 2.* As shown above, Jain et al. disclose a system that satisfies the limitations of Claim 1. Jain et al. further disclose that the curve (of the fingerprint ridge) is "expressed on" a "periodic grid" of pixels (i.e. ridges are depicted in captured images of the fingerprint – Jain et al. column 7, lines 66-67). However, Jain et al. does not expressly show or suggest[6] determining the position of measure points by interpolating positions of two nearest adjacent pixels on the curve.

50. Sparrow discloses a fingerprint recognition system, wherein the topology of the fingerprint can be reconstructed (Sparrow Fig. 1A, step 32) from an image (photograph) of the fingerprint (Sparrow Fig. 1A). Sparrow

6 Recall how this claim is being interpreted in this document.

suggests that spline interpolation can be used to reconstruct the topology of the fingerprint (Sparrow column 5, lines 63-67 to column 6, lines 1-2 and column 23, lines 19-21) from a set of minutiae (i.e. *characteristics* or topological irregularities, using Sparrow's nomenclature – Sparrow column 1, lines 16-19) and *recurves* (analogous to the Applicant's measure points – Sparrow column 20, lines 26-31) detected in the given fingerprint image. These minutiae correspond to pixels of the image (e.g. Sparrow Figs. 21(b)-12(c)). See Sparrow column 20, lines 51-59.

51. Though it would be easily recognized by one of ordinary skill in the art that such an application of spline interpolation would involve the interpolation of adjacent pixels on the curve (e.g. adjacent minutia or recurves). The spline that interpolates these pixels yields additional points as evidenced by the reconstructed topologies shown in Sparrow Figs. 17-18. These points can be considered measure points because they lie on the ridges of the fingerprint.

52. The teachings of Sparrow and Jain et al. are combinable because they are analogous art, that is, both Sparrow and Jain et al. disclose fingerprint authentication systems. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to use spline interpolation to interpolate adjacent pixels (e.g. adjacent minutia or recurves) so as to yield additional measure points. The motivation for doing so would have been to provide points that are indicative of the topology or string-based representation of the fingerprint at a sub-pixel resolution. As a result, the resolution of topological or string-based representation would not be constrained to that of the captured fingerprint image.

53. Claims 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jain et al. in view of Yamaguchi et al. (U.S. Patent 6,314,196). To distinguish between U.S. Patent 6,314,196 and other patents by Yamaguchi et al. that may be cited in this document, U.S. Patent 6,314,196 will be referred to as Yamaguchi (196).

54. *The following is in regard to Claim 3.* As shown above, Jain et al. disclose a system that satisfies the limitations of Claim 1. Jain et al. further disclose:

(3.a.) Block partitioning to partition whole image data into blocks (Jain et al. Fig. 3A, step 310). Typically, local ridge orientation is usually specified for a block rather than at every

pixel in the image. Thus, block direction step 310 of Jain et al. inherently involves the partitioning the image into blocks.

(3.b.) Binarizing[7] the fingerprint image. Since fingerprint shape is of primary importance in fingerprint authentication, fingerprint recognition systems typically discard all color information and utilize binarized images of fingerprints. This has the advantage of reducing the size of the image. More importantly, the ridge and valley structure of the fingerprint is accentuated by eliminating the nuanced color fluctuations about the fingerprint's ridges and valleys. Therefore, though not explicitly disclosed by Jain et al., it can reasonably be assumed that the system of Jain et al. processes binarized fingerprint images.

(3.c.) Deriving directions of ridge in binary image (e.g. Jain et al. Fig. 3, step 310). and column 11, lines 65-67 to column 12, lines 1-5).

(3.d) Noise elimination to eliminate black data not located along directions of ridge (Jain et al. column 2, lines 38-45).

(3.e) Thinning by reducing width of ridge until ridge width becomes one pixel in size (Jain et al. column 2, line 43).

(3.f.) Eliminating false minutia (e.g. pruning – Jain et al. Fig. 2, step 230 and column 2, lines 3-4).

(3.g.) The remaining minutia are retained as true minutia after performing false minutia elimination. It should be clear that the minutiae that remain after pruning would be valid or "true" minutiae.

Jain et al., however, do not expressly show or suggest: (3.h.) A second binarization; nor that the "false" minutiae should include: minutiae located closely to each other, ending minutia located near bifurcation minutia, minutia located closely to image boundary, and isolated minutia without a ridge.

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7 Binarization produces a binary image (black and white). Binary images provide the highest contrast that can be achieved in the sense that optometrically disparate regions are differentiated by colors at the opposite ends of the image's color palette. Therefore, binarization, in and of itself, enhances contrast (to the greatest extent possible).

55. Yamaguchi (196) disclose a fingerprint registration and authentication system, wherein a fingerprint image is binarized a first time (Yamaguchi (196) column 35, lines 43-54), minutiae are extracted from the binarized image (Yamaguchi (196) column 35, lines 50-54) with false minutiae (i.e. *pseudo-minutia*) removed, and, if the number of minutiae is less than a predefined amount (Yamaguchi (196) column 35, lines 67 to column 36, lines 1-9), the original fingerprint image is spatially filtered (Yamaguchi (196) column 36, lines 4-23) and binarized again (Yamaguchi (196) column 36,lines 24-28).

56. Yamaguchi (196) also disclose the removal of false minutiae (i.e. pseudo-minutiae - Yamaguchi (196)). As shown by Yamaguchi (196) (Yamaguchi (196) Fig. 31(C), column 1, lines 48-57, and column 11, lines 19-24), pseudo-minutiae can include:

1. Minutiae located closely to each other (Yamaguchi (196) column 11, lines 19-22).
2. Ending minutiae located near bifurcation minutia (e.g. Yamaguchi (196) Fig. 31(C), point P3). See Yamaguchi (196) column 1, lines 52-57.
3. Isolated minutiae without a ridge (Yamaguchi (196) Fig. 31(C), point P2).

57. The teachings of Yamaguchi (196) and Jain et al. are combinable because, *inter alia,* they both disclose minutiae-based fingerprint authentication systems. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to modify the system of Jain et al. to include the spatial filtering and secondary binarization of Yamaguchi (196)'s system, as summarized above. The motivation to do so would have been to reprocess the original image to ensure that cracks or the like become connected (Yamaguchi (196) column 36, lines 10-21), thereby ensuring that an adequate number of minutiae can be extracted (Yamaguchi (196) column 36, lines 45-50).

58. Claims 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jain et al. in view of Kamei et al. (U.S. Patent 5,974,163).

59. *The following is in regard to Claim 5.* As shown above, Jain et al. disclose a system that satisfies the limitations of Claim 1. Jain et al., however, do not expressly show or suggest extracting ending minutia using the

original binarized image and an inverted version of the binarized image in lieu of extracting both ending and bifurcation minutia using just the original black and white image.

60. Kamei et al. disclose a fingerprint classification system ridge ending minutiae and bifurcation minutiae are determined using both a binary image of the fingerprint (Kamei et al. column 9, lines 14-16) and an inverted binary image of the fingerprint. See Kamei et al. Fig. 10 (note block 96), Fig. 11 (note block 931), column 8 (lines 66-67) to column 9 (lines 1-3), and column 9 (lines 18-28 and 38-46).

61. The teachings of Kamei et al. and Jain et al. are combinable because they are analogous art. Specifically, the teachings of both Kamei et al. and Jain et al. are directed toward the analysis of fingerprint features. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to use both a binary image of the fingerprint and an inverted binary image of the fingerprint to derive ridge ending minutiae and bifurcation minutiae. According to Kamei et al. (Kamei et al. column 9, lines 14-22), the (thinned) binary image provides information related the ridge structures of the fingerprint, whereas the inverted (thinned) image provides information related to the valley structures of the fingerprint. The derived ridge ends, ridge bifurcations, valley ends, and valley bifurcations are used to detect a "dual correspondence" among ridge and valley minutiae (Kamei et al. column 8, lines 66-67 to column 9, lines 1-3). This advantageously ensures consistency among the detected ridge and valley structures of the fingerprint.

62. Claims 7 and 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jain et al. in view of Bergenek et al. (U.S. Patent 6,241,288).

63. *The following is in regard to Claim 7.* As shown above, Jain et al. disclose a system that satisfies the limitations of Claim 1. It should be evident from Jain et al.'s disclosure that different parts of the input fingerprint image are used to generate numerical data and that the whole of that image is processed. While Jain et al. clearly show this for a single input frame, Jain et al. does not show or suggest the application of their methodology to consecutive input frames corresponding to the same fingerprint.

64. Bergenek et al. disclose a fingerprint verification system, wherein sequential, multiple images of the candidate fingerprint are acquired (Bergenek et al. column 3, lines 40-47 and column 12, lines 64-67 to column 13, lines 1-7).

65. The teachings if Jain et al. and Bergenek et al. are combinable because they are analogous art. Specifically, both Jain et al. and Bergenek et al. disclose fingerprint verification systems, wherein the ridge structure of the fingerprint is analyzed. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to apply the methodology of Jain et al. to multiple, sequentially captured images of the candidate fingerprint. Using multiple images, according to Bergenek et al. (Bergenek et al. column 13, lines 3-7), allows "dynamic properties of the fingerprint capture procedure ... [to] be sensed. For example, the multiple images can be compared to each other to improve image quality and to verify the stability of the reference point".

66. *The following is in regard to Claim 10.* As shown above, the teachings of Jain et al. and Bergenek et al, when combined in the manner suggest above, yields a system that satisfies the limitations of Claim 7. Neither Jain et al. nor Bergenek et al. show or suggest that it should take 0.24 (6/25) seconds to complete processing from image capture to processing the generated numerical data associated with an input fingerprint.

67. As disclosed by Bergenek et al., sequences of images can be captured of the fingerprint and analyzed to determine authenticity. It was well known, at the time of the Applicant's claimed invention, that video cameras are capable of capturing multiple, sequential images of an object. NTSC is the prevailing video standard used in North America. It was well known, at the time of the Applicant's claimed invention, that, according to the NTSC standard, video frames are captured at 1/25 of a second (i.e. 25 frames per second). Official Notice is taken.

68. According the Bergenek et al. (Bergenek et al. column 12, lines 65-67 to column 13, lines 1-3), between 5 and 50 images per second should be captured of the finger while it is pressed against the sensor. During that period (Bergenek et al. column 13, lines 1-3), the entire matching process 1200 for a frame (Bergenek et al. Fig. 13), including "complete processing from image capture to processing the generated numerical data associated with an input fingerprint", is completed. It should be clear that NTSC (25 frames per second) can provide image capture between 5 and 50 frames per second. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to use the NTSC standard when capturing images of the fingerprint. The

motivation to do so would have been to adhere to an accepted video standard. This, in turn, would allow the captured image sequence to be displayed on, or otherwise utilized by, NTSC compatible devices.

69. The target processing time (i.e. the time "to complete processing from image capture to processing the generated numerical data associated with an input fingerprint") of Bergenek et al.'s teachings (even when used in combination with NTSC) is clearly less than 0.24 seconds. Therefore, the system, obtained in the manner proposed above, can accommodate a processing time of 0.24 seconds.

70. *The following is in regard to Claim 9.* Before proceeding, note that the language "it is robust against any rotation and displacement of [the] input fingerprint image" merely proposes a supposed benefit of the claimed system. The phrase does not, in and of itself, introduce any additional structural or methodological limitations into the system of Claim 9. Furthermore, there is no clear reliance on these proposed benefits as being patentably significant (*STX LLC. v. Brine*, 211 F.3d 588, 591, 54 USPQ2d 1347, 1350 [Fed. Cir. 2000]). As such only the substantive limitations of Claim 9 will be treated.

71. As shown above, the teachings of Jain et al. and Bergenek et al, when combined and modified in the manner suggest above, yields a system that substantially satisfies the limitations of Claim 10. Jain et al. further discloses:

(9.a) Rotating coordinates of all minutia with a rotation angle (e.g. $\Delta\theta$ – Jain et al. column 12 line 25) around a specified origin (e.g. template minutia 810T in Jain et al. Fig. 9). See Jain et al. column 12, lines 59-67 to column 13, lines 1-14.

(9.b) Compensating minutia ridge shape for rotation of the said angle. See Jain et al. Fig. 9.

(9.c.) Employing fingerprint a matching method without compensation of displacement. As mentioned previously, the fingerprint matching (Jain et al. Fig. 6, steps 640-650) is based on the number of corresponding minutiae among the input and template fingerprint (Jain et al. column 8, lines 48-62 and column 22, lines 29-37). The matching procedure of Jain et al. is, therefore, absent any compensation of fingerprint displacement.

Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to rotate the minutiae, adjust the ridge shape to compensate for the rotation and perform matching, in accordance with items (9.a.)-(9.c.) above. The motivation for doing so would have been to align the input and

template fingerprint ridge structures, or string-representations, so that they may be analyzed within the same frame of reference (Jain et al. column 12, lines 33-42 and lines 49-51). By aligning these representations, in this manner, the incidence of false-negatives would be reduced, as topologically matching, yet rotated, fingerprints would no longer be erroneously rejected.

72. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jain et al. in view of Setlak et al. (U.S. Patent 5,828,773).

73. *The following is in regard to Claim 15.* As shown above, Jain et al. disclose a system that satisfies the limitations of Claim 1. It should be clear from Fig. 5 of Jain et al. that the system of Jain et al. is embedded in hardware or software. However, Jain et al. do not expressly show or suggest its application to data protection, wherein access to the hardware or software requires fingerprint authentication.

74. Setlak et al. disclose an application of fingerprint authentication to data protection, wherein access to a computer workstation (which includes data, software, and hardware) is based upon a match between a properly sensed fingerprint and a database of fingerprints for authorized users (Setlak et al. column 3, lines 55-58).

75. The teachings of Setlak et al. and Jain et al. are combinable because they are analogous art. Specifically, the teachings of Setlak et al. and Jain et al. are both directed towards systems involving fingerprint authentication. Therefore, given the teachings of Setlak et al., it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to apply the system of Jain et al. to data protection, wherein access to a computer workstation depends on fingerprint authentication. The motivation for doing so would have been to provide only those whose fingerprint has been authenticated access to a computer workstation.

Allowable Subject Matter

Objections, Allowable Subject Matter

76. Claim 6 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The claim must also be rewritten to overcome the U.S.C. § 112(1) and U.S.C. § 112(2) rejections stated above.

77. The following is a statement of reasons for the indication of allowable subject matter.

78. No prior art teaches were encountered that showed or suggested determining true and false minutiae by:

(6.a.) Taking 2 dimension coordinates with respect to an origin located at a bifurcation point.

(6.b.) Taking 3 points on different ridges leaving from the bifurcation point with the same distances from the bifurcation point.

(6.c.) Calculating the inner products of all pairs of point-vectors that can be obtained from the 3 point-vector that correspond, respectively, to said 3 points

(6.d.) Judging the bifurcation as a false bifurcation minutia if all calculated inner products are less than a specified value, and judging the bifurcation as a true bifurcation minutia, if all calculated inner products are not less than a specified threshold.

(6.e.) Judging ridge ending as a false ending minutia by using inner products over valleys if all inner products are less than a specified value, and, otherwise, judging the ending as a true ending minutia.

Citation of Relevant Prior Art

79. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

[1] *U.S. Patent 6,263,091*. Jain et al. Publish Date: July 2001.

Jain et al. discuss in more detail the partitioning of the image into blocks and the derivation of

ridge flow in the fingerprint.

[2] *U.S. Patent 5,454,070.* Donnely et al. Publication Date: September 1995.

Donnely et al. disclose a method of fitting a spline to pixelized curves (e.g. region boundaries) in a given image. The spline interpolates pixels comprising the curve and provides a spline based representation of the curve.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Siangchin whose telephone number is (703)305-7569. The examiner can normally be reached on 9:00am - 5:30pm, Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on (703)308-6604. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Kevin Siangchin

Examiner
Art Unit 2623

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